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PAINTABILITY OF FOUR WOODS IN HAWAII

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Abstract: Four paint combinations applied to simulated vertical siding of four wood species have been exposed outdoors in Hawaii since 1964. A three-coat, self-primed latex application is holding up best, with oil base primed latex, three-coat oil base, and two-coat oil base combinations next best in that order. Australian toon is holding paint best, followed by redwood, robusta eucalyptus, and Douglas-fir. For good service, durability, and appearance, three coats of self-primed latex on Australian toon or redwood are recommended.

Oxford: 833.14:829.18–018[176.1 *Toona australis* + 176.1 *Eucalyptus robusta* + 174.7 *Sequoia sempervirens* + 174.7 *Pseudotsuga menziesii*].
Retrieval Terms: Toona australis; Eucalyptus robusta; Sequoia sempervirens; Pseudotsuga menziesii.

Because softwood lumber products must be imported to Hawaii, locally grown hardwoods have some potential for use as house siding in competition with them. Thus far, these hardwoods have been used this way on only a small scale, so as yet little information on their performance characteristics has been gathered. One characteristic that has strong bearing on their expanded use is their ability to hold paint in outdoor exposure.

In 1964, a test was started to compare the paint-holding ability of two Hawaii-grown woods—Australian toon *(Toona australis)* and robusta *(Eucalyptus robusta)*—with two well-known softwoods—redwood *(Sequoia sempervirens)* and Douglas-fir *(Pseudotsuga menziesii)*.[1] The test compares 32 panels (each about 4 square feet). Each panel was made from four 1- by 6-inch flat-sawn tongue and grooved boards 2 feet long. Eight panels of each species are represented. The following four paint combinations were applied to two panels of each species:

- Three coats of Fuller[2] 9220 exterior self-primed paint.
- One prime coat of Federal Specification TT-P-25a oil base paint and two coats of Fuller 9220 latex paint.
- One prime coat of TT-P-25a oil base, and two coats of Federal Specification TT-P-102a white exterior oil base paint.
- One prime coat of TT-P-25a oil base, and one coat of TT-P-102a oil base paint.

All paint was applied by brush to only one side of the panels. No mildewcide or fungicide was added to the paint.

The panels were mounted in a randomized block experimental design on four plywood sheets *(fig. 1)*. The four units, consisting of eight panels each, were installed on fences in a south-facing vertical exposure at Makiki Valley, Honolulu.

At the site, the panels receive ambient insolation except from about May 27–July 16 each year, when the sun is north of Honolulu. Rainfall is about 70 inches per year, but the panels face away from the prevailing trade wind-driven rains, so are afforded some protection. The conditions are typical of those found in most of the more humid communities of Oahu.

RESULTS AND DISCUSSION

After 7 years, all paint combinations except the self-primed latex are showing some failure on all species of wood except Australian toon. Judged solely by the relative amount of bare wood showing on each board in each panel, the least successful paint combination is the two-coat oil base treatment, and the least paintable wood is Douglas-fir *(table 1)*. Robusta is slightly better than Douglas-fir as a substrate. The three coats of oil paint are faring considerably better than two coats of oil base, but neither combination compared well with the latex paints–particularly the self-primed latex.

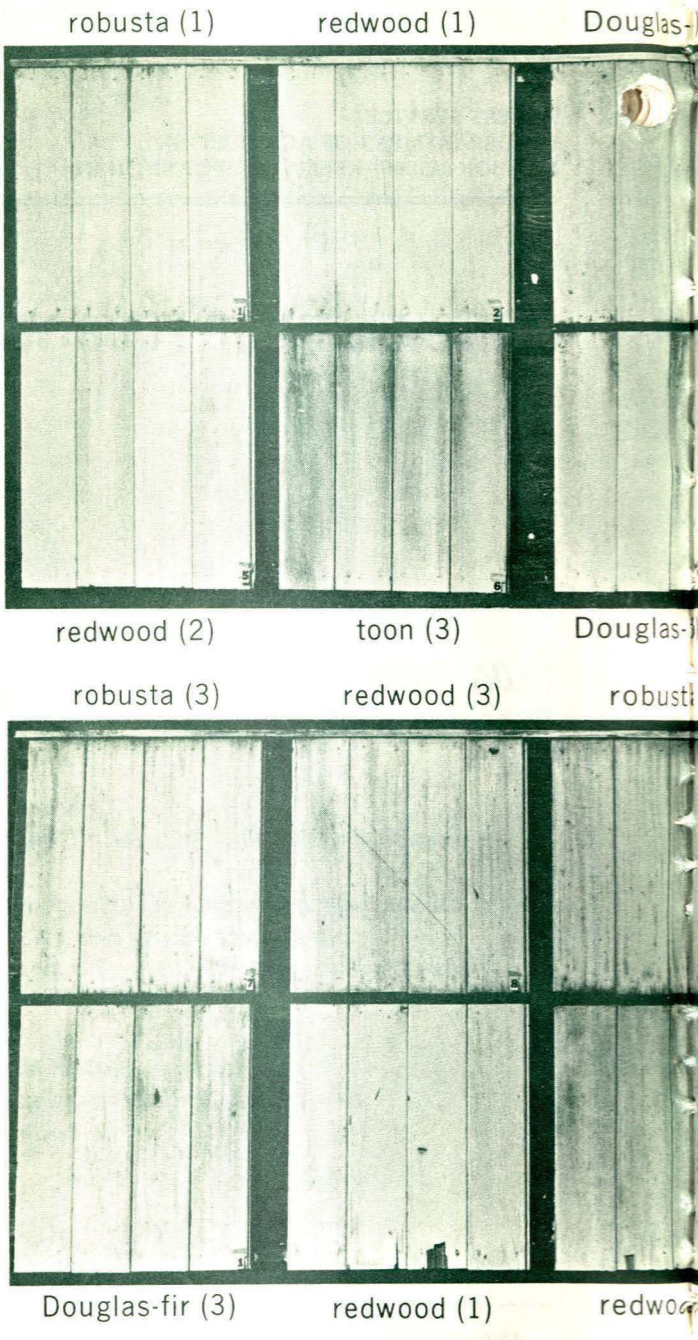
Redwood is usually considered to be an excellent wood in paint-holding ability. However, redwood is usually used quarter-sawn (edge-grain), in which case there is little wood movement under the paint with wetting and drying and virtually no surface separation of springwood and summerwood. The redwood used in this study was flat-sawn (slash grain) so that it would compare with the other three species, which are unavailable as quarter-sawn material. This difference may be the reason that paint failure is beginning earlier on redwood than on Australian toon.

Paint failure–peeling and flaking down to bare wood–became apparent on robusta and Douglas-fir

Table 1–*Condition rating of paint on boards, by species and paint combinations after 7 years of exposure, Makiki Exposure Site, Honolulu, Hawaii*

Species and condition[1] rating	Self-primed three coats latex	Oil primer two coats latex	Oil primer two coats oil finish	Oil primer one coat oil finish
	Number of boards			
Australian toon:				
Good	8	8	8	8
Fair	0	0	0	0
Poor	0	0	0	0
Bad	0	0	0	0
Redwood:				
Good	8	8	7	6
Fair	0	0	1	1
Poor	0	0	0	0
Bad	0	0	0	1
Robusta:				
Good	8	7	4	0
Fair	0	1	4	4
Poor	0	0	0	0
Bad	0	0	0	4
Douglas-fir:				
Good	8	6	2	0
Fair	0	2	5	2
Poor	0	0	1	2
Bad	0	0	0	4

[1]*Good:* no bare wood showing; *fair:* magnification required to see bare wood; *poor:* scattered small bare patches; *bad:* conspicuous bare patches over whole area.



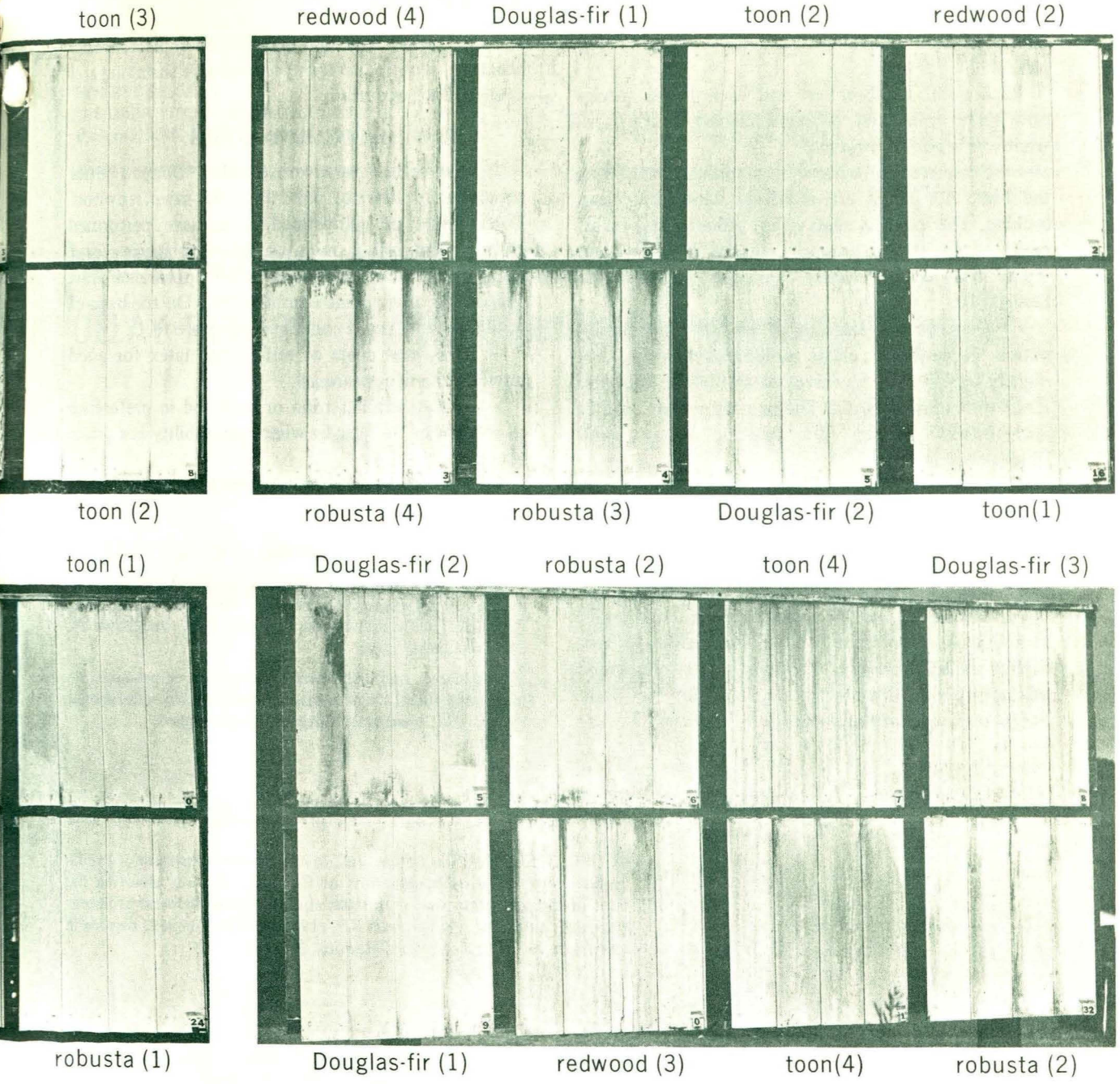


Figure 1—Appearance of panels in the four test units after 7 years of exposure, November 1971. Each panel is identified by species, and by treatment as follows: (1) three coats of latex paint; (2) one coat of oil base, two coats of latex; (3) three coats of oil base paint; (4) two coats of oil base.

given two coats of oil paint after 3-1/2 to 4 years of exposure. After 6 years of exposure, four of the panels with two-coats of oil—two of Douglas-fir and one each of robusta and redwood—were judged sufficiently deteriorated to require repainting if the wood had been in normal use. By 6-1/2 years, one of the panels with the three-coat oil combination had reached this state.

In the first years of this test, as reported by Boone[1] the most serious problem encountered was streaking, spotting, and over-all graying caused by mildew on the three paint combinations containing oil. The three-coat latex treatment did not mildew. This problem has subsequently become less serious. The paints have become chalky with age, and much of the mildew has eroded away. Furthermore, the

mildew is dry and loose and is easily brushed off the panels.

Each paint combination and each wood species now show somewhat different characteristics from what was reported earlier[1]:

- *Three coats of latex:* This combination is faring the best. All panels are relatively white and clean looking. The paint is chalky, but adheres well on all panels even though minute surface checking and separation have occurred on the robusta and Douglas-fir.
- *Two coats of latex on oil primer:* This combination is generally clean looking and white, but slightly less so than the three-coats of latex. Adhesion is also not quite as good. The paint is peeling slightly near breaks in the film on the robusta and Douglas-fir.
- *Three coats of oil base:* This combination shows extensive minute crazing and erosion on all wood species and now has a rather unique sandpaper-like surface. Peeling away from breaks in the film is now common on robusta and Douglas-fir.
- *Two coats of oil base:* This combination is already failing on robusta and Douglas-fir, and is starting to fail on redwood. But it is still completely satisfactory on Australian toon. The film has poor integrity except on Australian toon. It crazes, checks, and then flakes free, baring the wood in places where checking, wood separation, or excessive shrinking and swelling have occurred.

RECOMMENDATIONS

It appears that flat-sawn Australian toon is a better substrate for exterior paint than flat-sawn redwood. Three coats of self-primed latex have performed without film failure on any of the four species for 7 years and have a somewhat better appearance than any of the other paint combinations. On the basis of results to date, my recommendations are to. . .

- Use three coats of self-primed latex for good service life and appearance.
- Use Australian toon or redwood in preference to robusta or Douglas-fir where paintability is a prime concern.
- Use three coats, rather than two coats of paint for extended service life.

NOTES

[1]Boone, R. Sidney. *Paintability of two Hawaii-grown woods. . .first progress report.* U.S. Forest Serv. Res. Note PSW-116, Pacific SW. Forest & Range Exp. Stn., Berkeley, Calif. 6 p., illus. 1966.

[2]Trade names and commercial enterprises or products are mentioned solely for necessary information. No endorsement by the U.S. Department of Agriculture is implied.

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